Federal Democratic
Republic of Ethiopia

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ET ISO 3656 (2011) (English): Animal and vegetable fats and oils -- Determination of ultraviolet absorbance expressed as specific UV extinction

ISO INSIDE

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ETHIOPIAN
STANDARD

Animal and vegetable fats and oils- Determination of ultraviolet absorbance expressed as specific uv extinction

(Identical with ISO 3656:2011)

ICS:67.200.10

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Foreword

This Ethiopian Standard has been prepared under the direction of the Technical Committee for Animal and vegetables fats and oils (TC 23) and published by the Ethiopian Standards Agency (ESA).

The standard is identical with ISO 3656:2011, Animal and vegetable fats and oils -Determination of ultraviolet absorbance expressed as specific UV extinction, published by International Organization for Standardization (ISO).

For the purpose of this Ethiopian Standard, the adopted text shall be modified as follows.

- The phrase “International Standard” shall be read as “Ethiopian Standard”; and
- A full stop (.) shall substitute comma (,) as decimal marker.

Animal and vegetable fats and oils — Determination of ultraviolet absorbance expressed as specific UV extinction

1 Scope

This International Standard specifies a method for the determination of the absorbance at ultraviolet wavelengths of animal and vegetable fats and oils.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 661, *Animal and vegetable fats and oils — Preparation of test sample*

3 Terms and definitions

NOTE The usual policy of ISO/TC 34/SC 11 of using symbols specified in International Standard 80000[5] is not followed in this International Standard. The symbols are those used, for example, in Commission Regulation (EEC) No 2568/91[6].

For the purposes of this document, the following terms and definitions apply.

3.1

specific extinction ($K_{232} - K_{268} - K_{270}$)

absorbance of 1 g sample, dissolved in 100 ml isooctane or cyclohexane, measured in a 10 mm cell at the specific wavelengths 232 nm, 268 nm, and 270 nm

4 Principle

A sample is dissolved in isooctane or cyclohexane and the absorbance is measured spectrophotometrically in a specified ultraviolet wavelength range. The specific absorbance at 232 nm and 268 nm in isooctane or 232 nm and 270 nm in cyclohexane for a concentration of 1 g per 100 ml in a 10 mm cell is calculated.

5 Reagents

WARNING — Attention is drawn to the regulations which specify the handling of hazardous substances. Technical, organizational and personal safety measures shall be followed.

During the analysis, unless otherwise stated, use only reagents of recognized analytical grade and distilled or demineralized water or water of equivalent purity.

5.1 Solvent: isooctane (2,2,4-trimethylpentane) for the measurement at 232 nm and 268 nm or **cyclohexane** for the measurement at 232 nm and 270 nm, having an absorbance less than 0,12 at 232 nm and less than 0,05 at 250 nm against water, measured in a 10 mm cell.

6 Apparatus

The glassware used for the determination shall be thoroughly cleaned and rinsed with the solvent (5.1) before use so that it is free from impurities having an absorbance within the wavelength range of 220 nm to 360 nm.

Usual laboratory apparatus and, in particular, the following.

6.1 One-mark volumetric flasks, capacity 25 ml, ISO 1042[1] class A.

6.2 Analytical balance, capable of being read to the nearest 0,000 1 g.

6.3 Spectrometer, with quartz cells of pathlength 10 mm, suitable for measurements at ultraviolet wavelengths (220 nm to 360 nm).

6.3.1 General. Before use it is recommended that the wavelength and absorbance scales of the spectrometer be checked as specified in 6.3.2 and 6.3.3.

6.3.2 Wavelength scale. Check this using a reference material consisting of an optical glass filter containing holmium oxide which has distinct absorption bands. The reference material is designed for the verification and calibration of the wavelength scales of visible and ultraviolet spectrophotometers having nominal spectral bandwidths of 5 nm or less. The holmium glass filter is measured in the absorbance mode against an air blank, over the wavelength range 640 nm to 240 nm. For each spectral bandwidth (0,10, 0,25, 0,50, 1,00, 1,50, 2,00, and 3,00), a baseline correction is performed with an empty cell holder. The wavelengths of the spectral bandwidth are listed in the certificate of the reference material1).

6.3.3 Absorbance scale. This may be checked using a reference material consisting of four solutions of potassium dichromate in perchloric acid sealed in far UV quartz cells to measure the linearity and photometric accuracy reference in the UV. The potassium dichromate filled cells (40 mg/ml, 60 mg/ml, 80 mg/ml and 100 mg/ml) are measured against a perchloric acid blank (see Reference [7]). The net absorbance values are listed in the certificate of the reference material1).

7 Sampling

Sampling is not part of the method specified in this International Standard. A recommended sampling method is given in ISO 5555[2].

It is important the laboratory receive a truly representative sample which has not been damaged or changed during transport or storage.

8 Preparation of test sample

Prepare the test sample in accordance with ISO 661.

Ensure that the test sample is perfectly homogeneous and contains no suspended impurities. Filter oils which are liquid at ambient temperature through paper at a temperature of approximately 30 °C. Homogenize and filter hard fats at a temperature of not more than 10 °C above their melting point.

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1) Suitable holmium filters and potassium dichromate-sealed cells are available commercially, e.g. from Starna Scientific (www.starnascientific.com). This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of this supplier.

9 Procedure

9.1 Test portion and preparation of the test solution

9.1.1 Weigh, to the nearest 0,1 mg (6.2), an amount of the test sample, generally 0,05 g to 0,25 g, necessary to obtain absorbance values between 0,2 and 0,8, into a 25 ml volumetric flask (6.1).

9.1.2 K_{232}/K_{268}. Dissolve the test portion at ambient temperature in a few millilitres of isooctane (5.1) for the determination of the specific absorbance at 232 nm and 268 nm and then make up to the mark with the same solvent. Mix thoroughly.

9.1.3 K_{232}/K_{270}. Dissolve the test portion at ambient temperature in a few millilitres of cyclohexane (5.1) for the measurement of the specific absorbance at 232 nm and 270 nm and then make up to the mark with the same solvent. Mix thoroughly.

9.1.4 Ensure that the solutions prepared in 9.1.2 and 9.1.3 are perfectly clear. If opalescence or turbidity is present, filter quickly through paper.

If the concentration of test sample in the test solution is greater than 1 g per 100 ml of solution, this shall be stated in the test report.

9.2 Determination

Rinse a quartz cell (6.3) three times with the test solution (9.1). Fill the cell with the test solution and measure the absorbance against the solvent used for dilution, by means of the spectrometer (6.3), over the wavelength range 220 nm to 360 nm, either continuously or at intervals of 1 nm or 2 nm, reducing the intervals to 0,5 nm in the regions of maximum and minimum absorbance.

NOTE It is possible that it is not necessary to measure the absorbance over the full wavelength range.

If the absorbance value obtained exceeds 0,8, dilute the test solution as appropriate and repeat the determination.

10 Expression of results

10.1 Specific extinction (extinction coefficients) at a specific wavelength

The specific extinction, K_λ (extinction coefficient) at a specific wavelength, λ, is calculated as follows:

$$K_\lambda = \frac{E_\lambda}{c\,s}$$

where

E_λ is the extinction measured at wavelength λ;

c is the concentration, in grams per 100 ml, of the solution;

s is the pathlength, in centimetres, of the cuvette.

Express the results to two decimal places.

10.2 Variation of the specific extinction, ΔK

Spectrophotometric analysis of olive oil in accordance with Commission Regulation (EEC) No 2568/91[6] also involves the determination of the variation of the specific extinction, ΔK, which is given by:

$$\Delta K = K_m - \frac{K_{m-4} + K_{m+4}}{2}$$

where K_m is the specific extinction at wavelength m, wavelength for maximum absorption which depends on the solvent used.

The results of this determination are expressed to two decimal places.

11 Precision

11.1 Interlaboratory test

Details of an interlaboratory test are summarized in Annex A. It is possible that the values derived from this interlaboratory test are not applicable to concentration ranges other than those given.

11.2 Repeatability

The absolute difference between two independent single test results, obtained using the same method on identical test material in the same laboratory by the same operator using the same equipment within a short interval of time, will in not more than 5 % of cases be greater than the overall repeatability limit, r.

11.3 Reproducibility

The absolute difference between two single test results, obtained using the same method on identical test material in different laboratories with different operators using different equipment, will in not more than 5 % of cases be greater than the overall reproducibility limit, R.

12 Test report

The test report shall contain at least the following information:

a) all information necessary for the complete identification of the sample;

b) the sampling method used, if known;

c) the test method used, with reference to this International Standard (ISO 3656:2011);

d) all operating details not specified in this International Standard, or regarded as optional, together with details of any incidents which may have influenced the test result(s);

e) the test result(s) obtained;

f) if the repeatability has been checked, the final quoted result obtained.

Annex A
(informative)

Results of interlaboratory test

An interlaboratory test was carried out in 2009 in accordance with ISO 5725-1[3] and ISO 5725-2[4] by the International Olive Council. A total of 22 laboratories from seven countries participated. The results are summarized in Tables A.1 to A.6.

Table A.1 — UV extinction at 232 nm in isooctane

Parameter	Sample				
	A	B	C	D	E
No. participating laboratories, n_{P}	**21**	**22**	**22**	**22**	**22**
No. laboratories retained after eliminating outliers, n_{p}	20	18	18	21	17
No. test results in all laboratories, n_{t}	40	36	36	42	34
Mean specific extinction at 232 nm, $\bar{K}_{232}$	1,763	2,104	3,805	3,847	2,817
Repeatability standard deviation, s_r	0,026	0,013	0,016	0,036	0,019
Coefficient of variation of repeatability, $C_{V,r}$, %	1,5	0,6	0,4	0,9	0,7
Repeatability limit, r	0,072	0,035	0,043	0,101	0,054
Reproducibility standard deviation, s_R	0,077	0,069	0,016	0,036	0,069
Coefficient of variation of reproducibility, $C_{V,R}$, %	4,4	3,3	4,6	5,5	2,5
Reproducibility limit, R	0,216	0,194	0,488	0,582	0,194

Table A.2 — UV extinction at 232 nm in cyclohexane

Parameter	Sample				
	A	B	C	D	E
No. participating laboratories, n_{P}	**21**	**21**	**21**	**21**	**21**
No. laboratories retained after eliminating outliers, n_{p}	18	20	20	21	21
No. test results in all laboratories, n_{t}	36	40	40	42	42
Mean specific extinction at 232 nm, $\bar{K}_{232}$	1,758	2,122	3,827	3,863	2,789
Repeatability standard deviation, s_r	0,025	0,022	0,042	0,041	0,033
Coefficient of variation of repeatability, $C_{V,r}$, %	1,4	1,0	1,1	1,1	1,2
Repeatability limit, r	0,070	0,060	0,119	0,113	0,093
Reproducibility standard deviation, s_R	0,049	0,073	0,151	0,138	0,100
Coefficient of variation of reproducibility, $C_{V,R}$, %	2,8	3,4	4,0	3,6	3,6
Reproducibility limit, R	0,138	0,204	0,424	0,386	0,279

Table A.3 — UV extinction at 268 nm in isooctane

Parameter	Sample				
	A	B	C	D	E
No. participating laboratories, n_P	**21**	**22**	**22**	**22**	**22**
No. laboratories retained after eliminating outliers, n_p	20	18	20	17	20
No. test results in all laboratories, n_t	40	36	40	34	40
Mean specific extinction at 268 nm, $\bar{K}_{268}$	0,124	0,425	1,140	0,450	0,598
Repeatability standard deviation, s_r	0,005	0,005	0,016	0,007	0,007
Coefficient of variation of repeatability, $C_{V,r}$, %	4,0	1,2	1,4	1,5	1,1
Repeatability limit, r	0,014	0,014	0,043	0,018	0,018
Reproducibility standard deviation, s_R	0,010	0,016	0,030	0,013	0,034
Coefficient of variation of reproducibility, $C_{V,R}$, %	8,0	3,8	2,6	3,0	5,6
Reproducibility limit, R	0,028	0,045	0,083	0,038	0,094

Table A.4 — UV extinction at 270 nm in cyclohexane

Parameter	Sample				
	A	B	C	D	E
No. participating laboratories, n_P	**21**	**21**	**21**	**21**	**21**
No. laboratories retained after eliminating outliers, n_p	20	19	20	20	17
No. test results in all laboratories, n_t	40	38	40	40	34
Mean specific extinction at 270 nm, $\bar{K}_{270}$	0,128	0,430	1,120	0,450	0,589
Repeatability standard deviation, s_r	0,005	0,008	0,010	0,012	0,006
Coefficient of variation of repeatability, $C_{V,r}$, %	4,0	2,0	1,0	2,6	1,1
Repeatability limit, r	0,014	0,023	0,029	0,033	0,018
Reproducibility standard deviation, s_R	0,011	0,016	0,027	0,014	0,015
Coefficient of variation of reproducibility, $C_{V,R}$, %	8,5	3,7	2,4	3,2	2,5
Reproducibility limit, R	0,031	0,044	0,074	0,040	0,042

Table A.5 — Variation of the specific extinction ΔK at (270 ± 4) nm in cyclohexane

Parameter	Sample				
	A	B	C	D	E
No. participating laboratories, n_P	**20**	**21**	**21**	**21**	**21**
No. laboratories retained after eliminating outliers, n_p	19	20	19	20	18
No. test results in all laboratories, n_t	38	40	38	40	36
Mean specific extinction, $\overline{\Delta K}$	−0,002	0,002	0,085	0,035	0,047
Repeatability standard deviation, s_r	0,001	0,001	0,001	0,001	0,001
Coefficient of variation of repeatability, $C_{V,r}$, %	28,9	21,6	1,1	2,9	2,9
Repeatability limit, r	0,002	0,002	0,003	0,003	0,004
Reproducibility standard deviation, s_R	0,003	0,001	0,004	0,003	0,004
Coefficient of variation of reproducibility, $C_{V,R}$, %	147,5	52,0	5,1	7,6	8,1
Reproducibility limit, R	0,008	0,004	0,012	0,007	0,011

Table A.6 — Variation of the specific extinction ΔK at (268 ± 4) nm in isooctane

Parameter	Sample				
	A	B	C	D	E
No. participating laboratories, n_P	**21**	**21**	**22**	**22**	**22**
No. laboratories retained after eliminating outliers, n_p	21	18	21	20	20
No. test results in all laboratories, n_t	42	36	42	40	40
Mean specific extinction, $\overline{\Delta K}$	−0,002	0,000	0,082	0,031	0,042
Repeatability standard deviation, s_r	0,001	0,001	0,002	0,001	0,001
Coefficient of variation of repeatability, $C_{V,r}$, %	36,4	121,1	2,3	4,4	1,7
Repeatability limit, r	0,003	0,001	0,005	0,004	0,002
Reproducibility standard deviation, s_R	0,004	0,001	0,008	0,004	0,005
Coefficient of variation of reproducibility, $C_{V,R}$, %	148,2	234,8	10,0	12,6	10,6
Reproducibility limit, R	0,011	0,003	0,023	0,011	0,013

Bibliography

[1] ISO 1042, *Laboratory glassware — One-mark volumetric flasks*

[2] ISO 5555, *Animal and vegetable fats and oils — Sampling*

[3] ISO 5725-1, *Accuracy (trueness and precision) of measurement methods and results — Part 1: General principles and definitions*

[4] ISO 5725-2, *Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*

[5] International Standard 80000 (all parts), *Quantities and units*

[6] COMMISSION REGULATION (EEC) No 2568/91 of 11 July 1991. On the characteristics of olive oil and olive-residue oil and on the relevant methods of analysis. *Off. J.* 1991-09-05, **248**, p. 1. Available (viewed 2010-09-20) at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1991R2568:20080101:EN:PDF

[7] BURKE, R.W., MAVRODINEANU, R. *Certification and use of acidic potassium dichromate solutions as an ultraviolet absorbance standard SRM 935.* Washington, DC: National Bureau of Standards, 1977. 147 p. (*NBS Special Publication No. 260-54*.)

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Ethiopian Standards Agency

Organization and Objectives

The Ethiopian Standards Agency (ESA) is the national standards body of Ethiopia established in 2010 based on regulation No. 193/2010.ESA is established due to the restructuring of Quality and Standards Authority of Ethiopia (QSAE) which was established in 1970.

ESA's objectives are:-

- Develop Ethiopian standards and establish a system that enable to check weather goods and services are in compliance with the required standards,
- Facilitate the country's technology transfer through the use of standards,
- Develop national standards for local products and services so as to make them competitive in the international market.

Ethiopian Standards

The Ethiopian Standards are developed by national technical committees which are composed of different stakeholders consisting of educational Institutions, research institutes, government organizations, certification, inspection, and testing organizations, regulatory bodies, consumer association etc. The requirements and/ or recommendations contained in Ethiopian Standards are consensus based that reflects the interest of the TC representatives and also of comments received from the public and other sources. Ethiopian Standards are approved by the National Standardization Council and are kept under continuous review after publication and updated regularly to take account of latest scientific and technological changes.
Orders for all Ethiopian Standards, International Standard and ASTM standards, including electronic versions, should be addressed to the Documentation and Publication Team at the Head office and Branch (Liaisons) offices. A catalogue of Ethiopian Standards is also available freely and can be accessed in from our website.

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International Involvement
ESA, representing Ethiopia, is a member of the International Organization for Standardization (ISO), and Codex Alimentarius Commission (CODEX). It also maintains close working relations with the international Electro-technical Commission (IEC) and American Society for Testing and Materials (ASTM).It is a founding member of the African Regional Organization for standardization (ARSO).

More Information?
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